

Foods of Birds of Prey in Virginia. Part I. Stomach Analyses

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INTRODUCTION

Determining the specific foods taken by birds of prey can be accomplished in several ways: field observations, identifying food brought to nestlings, examining regurgitated material (pellets), analyzing crop and stomach contents, locating food caches, and examining nest debris. In Virginia, for example, Golden Eagles have been observed pursuing a variety of birds and mammals, as well as consuming carrion (Johnston, 1994), and Ellzey (1888) watched a Sharp-shinned Hawk catch a Northern Bobwhite. Prey remains in or under nests of Red-tailed Hawks and Great Horned Owls were identified by Murray (1943) and Sykes (1961), respectively. Nest boxes used by Eastern Screech-Owls contained the remains of crayfish, frogs, and small birds (Reiger, 1992). Hunting and chasing behaviors of migrating raptors as they pursued small birds were described in detail by Hill (1984).

Despite these and other records published in *The Raven* and elsewhere and despite the observations by ornithologists in Virginia over the last century or more, with few exceptions relatively little is known about specific foods taken by birds of prey in the State. In this paper I present the identification of stomach contents from birds of prey in the State. Although many of the specimens came from northern parts of Virginia, the results presented here bear implications for the State as a whole.

MATERIALS

Over the past decade, 266 dead birds of prey specimens of 18 species have come into my possession. Most were road-kills. From these, records of stomach contents were kept. These records plus those gleaned from the literature are included in this paper. Many of

the birds were prepared as specimens or mounts and donated to museums and nature centers.

In the species accounts below, the "stomach contents" column for each species contains the prey items identified. The "source" column includes literature citations and providers. Also, "USFWS" refers to the food habits files of the U.S. Fish and Wildlife Service at Patuxent Wildlife Research Center in Laurel, MD. Raptor carcasses studied at the National Wildlife Health Research Center in Madison, WI are identified as "NWHRC." Several people who provided specimens are listed under "source"--Charles Ziegenfus (CZ), Llyn Sharp (LS), Roy Geiger (RG), Robert Simpson (RS), Ralph Eckerlin (RE), Clair Mellinger (CM), Martin Ogle (MO), John Rappole (JR), Ken Bass (KB), and licensed rehabilitators (Wildlife Center of Virginia, J. Freitag, A. Hocker, P. Whiddon). Appendices A and B contain the names of counties and cities abbreviated in the text and the scientific names of vertebrate prey.

RESULTS AND DISCUSSION

The most exhaustive accounts of foods of birds of prey in North America were published by A. K. Fisher (1888, 1893). Therein, he identified the stomach contents of hundreds of birds from all over North America, only a few of which were from Virginia. Other lengthy reports of raptor foods (Smyth 1894, McAtee 1935) copied Fisher's work and added little specifically for the State. May (1935) provided summaries of nonspecific food categories taken by diurnal birds of prey from previous studies.

Results of the stomach analyses are found in Table 1. As other authors have done, the specific foods can be put into general categories (e.g., insects, mice, birds) (Table 2). With few exceptions the percentages of prey in the several categories from Virginia are close to those given

Table 1. Stomach contents of birds of prey in Virginia.

SPECIES DATE	LOCATION (APPENDIX A)	AGE/ SEX	STOMACH CONTENTS	SOURCE
Turkey Vulture (<i>Cathartes aura</i>)				
1936-06-29	PRG: Camp Lee		Corn Snake, White-footed Mouse	Nelson & Greenfield 1936
Bald Eagle (<i>Haliaeetus leucocephalus</i>)				
1882-12-00	NFC		duck	Fisher 1893
1980-00-00	Unknown	Ad♂	grass	NWHRC
1981-09-28	KIG	Im♀	unidentified mass	"
1982-05-03	SUR	Im♂	fish	"
1982-08-16	Unknown	Im♀	fish	"
1985-05-11	GLO	nestling♀	fish remains	"
1985-05-15	Unknown	Ad?	fish scales, feathers	"
1986-01-22	CHS	Ad♂	plant material	"
1986-04-23	ESS	Im♂	fish remains	"
1988-01-21	WES	Ad♀	fish remains	"
1988-11-18	KIW	Ad♀	fish remains	"
1988-12-00	DIC	Ad♀	meat and hairs	"
1989-09-26	KIG	Im♀	fish remains	"
1989-10-07	YOR	Ad♂	fish remains	"
1991-03-21	KIG	Im♂	gray hairs	"
1991-04-08	CHA	Ad♂	feathers, bones	"
1991-06-03	HEN	Im♂	fish remains	"
1991-08-27	Unknown	Im♂	fish remains	"
1992-03-19	KIG	Ad♀	feathers, fur, bones	"
1992-04-19	WES	Im♀	meat and hairs	"
1993-02-02	SPO	Im♀	feathers	"
1993-09-15	CPC	Ad♀	fish remains	"
1993-12-20	HAN	Ad♂	hairs, grass	"
Northern Harrier (<i>Circus cyaneus</i>)				
1892-10-25	FAI		Meadow Mouse [Vole]	USFWS
ca. 1894	MON?		grasshoppers	Smyth 1894
ca. 1894	MON?		sparrow	"
1913-05-08	ACC: Wallops Island		Meadow Mouse [Vole]	USFWS
1913-05-12	ACC: " "		Semipalmated Sandpiper	"
1913-09-15	ACC: " "		Water Pipit, White-footed Mouse	"
1916-09-02	ACC: " "		Spotted Sandpiper	"
1916-09-02	ACC: " "		2 Semipalmated Sandpipers	"
1916-09-04	ACC: " "		Semipalmated Sandpiper	"
1916-09-16	ACC: " "		2 Black-and-white Warblers, 3 Field Sparrows, 1 <i>Dendroica</i> sp.	"
1916-09-22	ACC: " "		Clapper Rail	"
1919-09-29	ACC: " "		Meadow Mouse [Vole], Leopard Frog, grasshopper	"
1919-09-30	ACC: " "		Leopard Frog	"
1919-09-30	ACC: " "		Leopard Frog, Chorus Frog, Least Shrew, <i>Dendroica</i> sp.	"

SPECIES DATE	LOCATION (APPENDIX A)	AGE/ SEX	STOMACH CONTENTS	SOURCE
Northern Harrier				
1934-09-00	LUI: Trevilians		Meadow Mouse [Vole], White-footed Mouse, 5 katydids, 3 long-horned grasshoppers, June beetle, moth, spider	USFWS
Sharp-shinned Hawk (<i>Accipiter striatus</i>)				
1890-12-10	FAI: Dunn Loring		Hermit Thrush	Fisher 1893
1900-05-25	ARL: Rosslyn		House Mouse	USFWS
1991-04-27	ALE	Im ♀	Starling	
1991-07-05	Shenandoah Natl. Park	Ad ♂	feather fragment	JR
1992-00-00	NNC	Ad ♂	2 sets of small unidentified passerine feet	
1993-05-01	LUD	Im ♀	Northern Cardinal (♂)	
1993-10-06	ALE	Im ♀	Red-winged Blackbird (♂)	
1994-11-09	FAI: Annandale	Im ♀	House Sparrow	
1994-00-00	FAI	Im ♂	Dark-eyed Junco	RG
1997-12-07	ALE	Im ♀	feather fragments	
1998-01-14	ALE	Im ♀	House Sparrow (♂)	
1999-02-10	HAR	Im ♀	Yellow-rumped Warbler	CM
Cooper's Hawk (<i>Accipiter cooperii</i>)				
1900-12-05	S. Virginia		Northern Bobwhite	USFWS
1917-11-00	Virginia near Washington		chicken	"
1924-03-11	FAI: Boulevard		chicken	"
1937-06-23	AUG		Gray Squirrel, House Mouse, Mourning Dove, Lepidoptera larvae, insect fragments	"
1990-10-00	SHE	Im ♂	Meadow Vole, wasp, 5 scarab beetles, 2 other beetles	RS
1990-10-23	FRE: Winchester	Im ♀	fur, feathers	"
1991-00-00	N. Virginia	Im ♀	Rock Dove	MO
1995-12-23	FAI: McLean	Ad ♀	Mourning Dove	
1996-03-17	FAI: Sterling	Im ♀	Starling	RG
1997-01-19	ARL: Interstate 395	Im ♀	Starling, House Mouse	
1997-02-00	VBC	Ad ♀	Mourning Dove	
1997-10-16	FAI	Im ♀	Eastern Chipmunk	
1997-12-04	PRW: Dumfries	Im ♀	feather fragments	
1997-12-00	LUD: Leesburg	Im ♂	mouse parts	
Red-shouldered Hawk (<i>Buteo lineatus</i>)				
1888-12-01	ALB: Cobham		46 grasshoppers, 2 crickets, 30 beetles	Fisher 1893
1892-12-18	ALE		Short-tailed Shrew, mouse hair, grasshopper	USFWS
ca. 1894	MON?		large black spider	Smyth 1894
ca. 1894	MON?		grasshoppers	"
ca. 1894	MON?		grasshopper, crayfish, 2 "spring lizards"	"

SPECIES DATE	LOCATION (APPENDIX A)	AGE/ SEX	STOMACH CONTENTS	SOURCE
Red-shouldered Hawk				
1910-11-22	VBC: Lynnhaven		grasshoppers	USFWS
1911-12-00	FAC		28 grasshoppers (3 species), Painted Turtle	"
1914-10-15	VBC: Lynnhaven		grasshoppers, beetles	"
1914-10-15	VBC: Lynnhaven		moths, spider, caterpillars	"
1934-08-20	LUI: Trevilians		cicadas, snake scales, short-and long-horned grasshoppers	"
ca. 1990	N. Virginia		insect remains	
1990-03-01	FAI: Springfield	Im ♀	insect remains, hair, plant material	RE
1991-00-00	N. Virginia	Ad ♀	insect remains	
1992-03-09	FAI: Great Falls	Im ♀	Gray Squirrel	
1993-03-19	FAI	Ad ♂	Eastern Chipmunk	
1993-08-07	PRW	Im ♀	House Mouse, Norway Rat	
1994-02-09	LUD: Lovettsville	Ad ♀	Short-tailed Shrew in crop	
1994-07-26	FAI: Dunn Loring	Im ♂	fur	
1994-00-00	FAI	Ad ♀	snake scales	RG
1996-04-11	PRW: Nokesville	Ad	beetles	KB
1997-09-00	FAI	Im ♂	hair	
Broad-winged Hawk (<i>Buteo platypterus</i>)				
1889-09-20	Virginia		11 Lepidoptera larvae, 1 white grub, 1 beetle, 1 katydid, 1 stone cricket	Fisher 1893
1889-09-29	Virginia		insect larvae, beetles, katydid, stone cricket	USFWS
1892-05-13	ALB: Cobham		Five-lined Skink (im.), beetle	Fisher 1893
1892-05-13	ALB: Cobham		young rabbit, 2 Short-tailed Shrews, Five-lined Skink	"
1906-05-18	MON: Blacksburg	Ad ♀	young rat	Burns 1911
1986-06-00	PRW: Bull Run	Ad ♂	"meat"	
1987-09-20	FAI: Carlin Spring Road	Im ♂	Rough Green Snake, camel cricket, wasp, hair, long- & short-horned grasshoppers	
1994-00-00	FAI	Ad ♂	giant water bug	RG
1995-05-08	ALE: Hollin Hill	♀	scarab beetles	
1996-08-01	MON: Blacksburg		Short-tailed Shrew	LS
Red-tailed Hawk (<i>Buteo jamaicensis</i>)				
1888-01-02	PRW: Gainesville		2 House Mice	Fisher 1893
1888-09-05	FAU: The Plains		insect	"
1891-02-05	CHS: Drewry's Bluff		mouse hair	"
1934-05-04	LUI		Meadow Vole, short-horned grasshopper	USFWS
1934-05-04	LUI		2 short-horned grasshoppers	"
1934-05-04	LUI		short-horned grasshoppers, moth larvae, feather	"

SPECIES DATE	LOCATION (APPENDIX A)	AGE/ SEX	STOMACH CONTENTS	SOURCE
Red-tailed Hawk				
1934-05-04	LUI		short-horned grasshopper	USFWS
1934-09-00	LUI: Trevilians		5 short-horned grasshoppers, June beetle, hawk (sphinx) moth	"
1935-12-22	LYC		Least Shrew	"
1993-05-10	PRW: Haymarket	Ad♀	Gray Squirrel, cottontail bones	
1993-11-05	LUD: Route 606	Im♂	mouse fur	
1993-11-11	SHE: Edinburg	Im♀	crop - Meadow Vole; stomach - 3 Meadow Voles, grasshopper	RS
1993-12-09	ROB: Lexington	Ad♂	Meadow Vole	
1994-01-31	FAI: Burke	Ad♀	amorphous mass	
1994-02-09	FAI: Tyson's Corner	Im♀	crop - 2 Meadow Voles, 1 Short-tailed Shrew; stomach - 3 Meadow Voles	
1995-01-00	AUG	Ad♀	Meadow Vole	
1995-03-18	CAR: Port Royal	Im♀	Short-tailed Shrew	
1995-12-22	FAI: Fairfax Station	Im♂	Starling	
1997-02-25	FRE: Interstate 81	Ad♂	2 Meadow Voles	RS
1998-07-00	FAU	Im♀	insects	
Rough-legged Hawk (<i>Buteo lagopus</i>)				
2000-02-05	SHE: New Market	Ad♀	roadkill Eastern Cottontail	RS
Golden Eagle (<i>Aquila chrysaetos</i>)				
1930-12-24	MEC		young goat	USFWS
1989-12-00	DIC	Im♀	small hollow hairs	NWHRC
1997-11-30	SCO	Ad♂	White-tailed Deer	PS
American Kestrel (<i>Falco sparverius</i>)				
ca. 1894	MON?		sphinx moth larvae	Smyth 1894
ca. 1894	MON?		crickets	"
ca. 1894	MON?		miscellaneous insects	"
ca. 1894	MON?		Meadow Vole	"
ca. 1894	MON?		Field Sparrow	"
1895-11-27	WES: Colonial Beach		3 crickets, 1 beetle, 3 grasshoppers, 13 hairy caterpillars, 2 spiders	USFWS
1989	ROI: Hinton	♀	insect larvae	
1989-02-04	STA	Ad♂	Meadow Vole, grasshopper	
1990-12-05	FRE: near Nain	Ad♂	5 short-horned grasshoppers , 1 noctuid moth larva	RS
ca. 1990	N. Virginia		small black beetles	
1991-05-30	FAU: Paris	♂	6 spiders	RS
1992-08-00	PRW: Nokesville	♂	beetles, wasp	KB
1993-01-26	ROI: Harrisonburg	♀	Starling	CM
1993-08-07	ARL: Pentagon	Im♀	beetles	
1995-04-26	VBC: Back Bay NWR	♂	insects	
1997-00-00	ROI	♂	Orthoptera	CZ

SPECIES DATE	LOCATION (APPENDIX A)	AGE/ SEX	STOMACH CONTENTS	SOURCE
Merlin (<i>Falco columbarius</i>)				
1889-10-13	FAI		warbler	Fisher 1893
1891-11-14	ARL: Ballston		2 House Sparrows, 1 other bird (junco?)	"
1894-10-18	WES: Kinsale		moth, small bird	USFWS
1911-09-07	ACC: Wallops Island		sandpiper	"
1913-09-15	ACC: " "		Cedar Waxwing	"
1916-09-30	ACC: " "		Indigo Bunting	"
1919-09-27	ACC: " "		House Sparrow, warbler ?, dragonfly	"
1932-11-15	KIW: Pamunkey Indian Reservation		Mourning Dove	"
1997-09-23	FAI: Chantilly	♀	beetles	
Peregrine Falcon (<i>Falco peregrinus</i>)				
1980-12-29	VBC	Ad♀	feathers, small bones	NWHRC
1984-11-01	VBC	Im♀	feathers	"
1986-10-06	NOA	Im♂	skeletal muscle	"
1990-07-15	GLO	Im♂	feathers	"
1992-02-05	HMC	Ad♀	feathers, bird foot	"
1993-10-04	NOA	Im♂	unidentified mass	"
Common Barn-Owl (<i>Tyto alba</i>)				
1919-09-28	ACC: Wallops Island		2 Meadow Voles	USFWS
1940-04-16	BUK: Farmville		Meadow Vole, Short-tailed Shrew	"
1988-07-00	FRE	♀	Short-tailed Shrew	RS
1995-02-00	LUD: Gilberts Corner		Meadow Vole	"
1996-04-26	AUG: Interstate 64	♂	Meadow Vole	
Eastern Screech-Owl (<i>Otus asio</i>)				
1890-12-21	FAI		Swamp Sparrow, House Mouse	Fisher 1893
1890-12-21	FAI		2 House Mice	"
	Virginia		small piece of flesh	"
	Virginia		small piece of flesh	"
1892-02-22	FCC		Dark-eyed Junco, Meadow Vole	"
1894-04-27	ARL?: Four-mile Run		insect remains	USFWS
1894-04-27	ARL		White-eyed Vireo, spider, sparrow, mouse	"
1894-05-10	ARL		beetle, cicada larvae	"
1896-02-22	ARL?: Four-mile Run		crayfish	"
1897-11-24	ARL		small bird, shrew and mouse hair	"
1900-02-04	ARL		<i>Peromyscus</i> sp.	"
1901-11-28	ORA: Gordonsville		House Mouse, spider	"
1935-11-01	LXC		beetle larvae, hair	"
1939-12-07	AUG: Deerfield		beetle larvae	"
1946-12-26	GIL: Mountain Lake		beetle, Lepidoptera larvae, spiders	"
1978-02-00	ARL	Ad♂	White-footed Mouse	MO
1980-09-25	BOT: Troutville	♂	earwigs, beetles, spiders, caterpillars, millipedes	LS

SPECIES DATE	LOCATION (APPENDIX A)	AGE/ SEX	STOMACH CONTENTS	SOURCE
Eastern Screech-Owl				
1986-07-26	ARL	ImU	beetles	MO
1986-10-19	PAG: Luray		insects	RS
1988-10-30	ARL: Route 50	Ad♀	camel crickets	
1990-00-00	ROI: near Harrisonburg	Ad♀	Meadow Vole	CZ
1990-00-00	ROI: “ ”	Ad♀	hair, beetles	“
1990-00-00	ROI: “ ”	Ad♂	Meadow Vole, beetles	“
1990-00-00	ROI: “ ”	Ad♀	insect remains	“
1990-00-00	ROI: “ ”	Ad♂	Eastern Fence Lizard, camel cricket	“
1990-00-00	ROI: “ ”	AdU	beetles	“
1990-00-00	ROI: “ ”	Ad♀	beetles	“
1990-00-00	ROI: “ ”	Ad♂	scarab beetle, many grasshopper parts, spider	“
ca. 1990	FRE: near Stephens City	Juv	long- and short-horned grasshoppers, 9 noctuid and 1 sphinx moth larvae	RS
1990-09-18	WAR: Front Royal	♂	grasshoppers, tree cricket, scarab beetle	“
1990-11-03	SHE: Red Banks	♀	scarab larva, earwig, short-horned grasshopper, 13 camel crickets, noctuid moth larva	“
1991-03-91	N. Virginia	Ad♀	centipedes, noctuid moth larvae	
1991-12-11	CLA: Boyce	Ad♂	noctuid moth larvae	RS
1992-02-10	WES: Montross	Ad♀	House Mouse	
1992-02-16	WAR: 4-H Club	♂	noctuid moths, spider, scarab beetle	JR
1992-03-09	VBC: Lynnhaven Inlet		4 black crickets	
1992-04-00	WIS	♀	beetles	
1992-04-00	WIS	♂	Lepidoptera larvae, millipedes, spider	
1992-08-07	FAI: Annandale	Im♀	cricket	
1992-09-24	FAI: Clifton	Ad♂	grasshopper, beetles	
1992-12-15	MON: Ellett Valley	♂	noctuid moth larvae, earwigs, ground beetles (Carabidae)	LS
1993-01-28	LUD: Round Hill		insects	
1993-05-07	LUD: Waterford	Im♂	many scarab beetles	
1993-06-00	WAR	♀	tree cricket	JR
1993-06-00	WAR		camel crickets, geometrid moth	“
1993-08-05	GIL: Narrows	♂	Lepidoptera larvae, beetles, spiders	LS
1993-10-25	MON: Christiansburg	♂	Lepidoptera, beetles, earwigs	“
1993-11-10	MON: Blacksburg	♂	Orthoptera, caterpillars, spiders	“
1994-12-14	FAI: Tyson's Corner	♀	noctuid moth larvae, geometrid moth	
1995-01-13	FRE: Route 522	♀	noctuid moth larvae, earthworms, carabid beetle larvae	RS
1995-08-00	WAR	♂	2 spiders, praying mantis, caterpillars, Noctuidae	JR
1995-11-08	WAR: Routes 522 & 604		caterpillars, Orthoptera	“
1996-02-03	PRW: Nokesville	♀	beetles	KB
1996-02-17	FAI: Reston	♂	Northern Cardinal (♂)	RG
1996-04-13	MAT: Port Haywood	♀	caterpillars, ground beetles, centipede	
1997-04-00	ROI	♂	wasp, caterpillars	CZ
1997-06-15	VBC: Back Bay NWR		beetles, ants	

SPECIES DATE	LOCATION (APPENDIX A)	AGE/ SEX	STOMACH CONTENTS	SOURCE
Eastern Screech-Owl				
1997-fall	ROI	♂	House Mouse	CZ
1997-10-04	WAR: Front Royal	♂	beetles	
1999-03-00	ROI	♀	insects	CM
1999-03-00	ROI	♂	small bones	"
Great Horned Owl (<i>Bubo virginianus</i>)				
1888-11-23	Virginia		Eastern Cottontail, Silver-haired Bat, spider, katydid	USFWS
1926-12-07	PRE: Farmville		Eastern Cottontail	"
1927-02-07	RIC ?		Eastern Cottontail	"
1928-10-14	CUL: Culpeper		Eastern Cottontail, spider	"
1989-11-30	WAR: Linden		Meadow Vole	RS
1990-00-00	ROI: near Harrisonburg	Ad♀	American Robin, Short-tailed Shrew	CZ
1990-00-00	ROI: "	Ad♂	dobsonfly	"
1990-00-00	ROI: "		weasel (sp. ?)	"
ca. 1990	FRE: Stephens City	Ad♀	small mammal bones	RS
ca. 1990	FRE: Stephens City	Ad♂	Meadow Vole, Least Shrew	"
1991-00-00	N. Virginia	Ad♀	House Mouse	
1993-07-05	FAI: Burke	Ad♀	4 scarab beetles, 1 camel cricket	
1993-12-09	ROI: Route 259		Short-tailed Shrew	
1994-04-07	PRW: Manassas	Ad♂	crayfish	
1994-12-08	LUD: Leesburg	Ad♀	Eastern Cottontail	
1995-09-20	LUD: Hamilton	Ad♂	beetles	RS
1995-10-01	FAI: Annandale	Ad♀	Eastern Cottontail	
1995-11-08	WYT: Interstate 77	♀	Harvest Mouse	LS
1995-00-00	FRE	Ad♀	insects	RS
1997-03-06	HAR: Interstate 81	♀	Orthoptera	
Snowy Owl (<i>Nyctea scandiaca</i>)				
Shufeldt (1914) examined an emaciated bird and found the "...Stomach entirely empty."				
Burrowing Owl (<i>Athene cunicularia</i>)				
1994-01-11	NOA: Chesapeake Bay Bridge Tunnel at Fisherman Island	♀	Carabid beetle parts	
Barred Owl (<i>Strix varia</i>)				
1888-10-21	Virginia		crayfish	Fisher 1893
1888-11-21	Virginia		crayfish	USFWS
1934-09-00	LUI: Trevilians		Cooper's Hawk, rhinoceros beetle, giant water bug, ground beetle, long- and short-horned grasshoppers	"
1975-02-10	FAI: Bull Run	Ad♂	80% earthworms, 10% Lepidoptera larvae, 10% unidentified matter	RE
1978-01-15	LUD: Leesburg	Ad♀	Short-tailed Shrew	"
1989-03-13	LUD	Ad♂	crayfish, frog	

SPECIES DATE	LOCATION (APPENDIX A)	AGE/ SEX	STOMACH CONTENTS	SOURCE
Barred Owl				
ca. 1990	N. Virginia		Short-tailed Shrew	RS
ca. 1990	N. Virginia		crayfish	"
ca. 1990	PRW	Ad♀	Meadow Vole	
ca. 1990	FRE: near Stephens City	Ad♀	10 camel crickets	RS
1991-00-00	N. Virginia		Norway Rat	"
1991-01-00	FRE: near Stephens City	Ad♀	Short-tailed shrew, rodent?	"
1991-04-16	FAI	♀	Gray Squirrel	
1992-06-30	FAI: Huntley Meadows Park	Ad♀	Red-bellied Woodpecker, beetles	
1993-01-03	PRW	Ad♀	insects	
1993-08-02	FAI: Grays Point Road	Im♂	Norway Rat	
1993-12-06	MON	♂	beetles	LS
1993-12-14	Interstate 64 at Route 617	♀	4 Meadow Voles	"
1994-00-00	FAI	♂	fur and insects	RG
1994-00-00	FAI	ImU	fur	"
1994-11-26	VBC: Back Bay NWR		Orthoptera	
1995-00-00	FAI	♀	insects	
1995-12-03	KIG: Dahlgren		House Mouse	
1996-04-23	FRE: Route 340	Ad♀	beetles	RS
1996-04-28	LUD: Route 611	♂	Tenebrionidae	
1997-05-00	LUD: Leesburg	♀	Short-tailed Shrew	
1998-02-11	FRE	♀	insects	RS
1998-02-29	JCC: Interstate 64	♀	Leopard Frog	
1998-04-30	ROI: Harrisonburg	♀	spider	CM
1998-10-15	FAU: Midland	♀	Short-tailed Shrew	
1999-04-16	FAI: Springfield	♀	<i>Peromyscus</i> sp.	
Long-eared Owl (<i>Asio otus</i>)				
1888-12-16	FAI		House Mouse, White-footed Mouse	Fisher 1893
1929-12-26	ROB	Ad♀	Mourning Dove	Murray 1944
1934-05-04	LUI: Trevilians		Meadow Vole	USFWS
1989-02-02	LUD: W&OD Trail	Ad♀	Meadow Vole	MO
Short-eared Owl (<i>Asio flammeus</i>)				
1996-04-17	VBC: Back Bay NWR		Sora	
Northern Saw-whet Owl (<i>Aegolius acadicus</i>)				
1956-02-12	Chesapeake City		House Mouse	Rageot 1957
1981-winter	N. Virginia	Ad♀	House Mouse	

[Note-Whalen et al. (2000) discuss prey taken by migrating Saw-whet Owls on Virginia's Eastern Shore from 1994 to 1996.]

Table 2. Summary of prey types taken from stomachs of birds of prey in Virginia. Numbers for each prey type are the percentages of full stomachs containing that prey.

SPECIES	Number examined	Mice, voles, shrews	Chipmunks, squirrels, rabbits	Larger mammals	Fish	Amphibians, reptiles	Birds	Insects	Other ^a	Number (%) empty
Turkey Vulture	1	100				100				0
Bald Eagle	32				52		22		22	9 (28)
Northern Harrier	16	40				20	53	20		1 (6)
Sharp-shinned Hawk	39	8					92			27 (69)
Cooper's Hawk	32	36	14				71	14		18 (56)
Red-shouldered Hawk	26	33	9			19			14	5 (19)
Broad-winged Hawk	12	30	20			30		60		2 (17)
Red-tailed Hawk	26	60	5				10			6 (23)
Rough-legged Hawk	1		100							0
Golden Eagle	7			100						4 ^b (57)
American Kestrel	21	13					13	75	13	5 (24)
Merlin	9						89	35		0
Peregrine Falcon	6						67		33	0
Common Barn-Owl	9									4 (44)
E. Screech-Owl	75	20				1	10	75	20	14 (22)
Great Horned Owl	32	40	35				5	30	15	12 (38)
Snowy Owl	1									1 (100)
Burrowing Owl	1							100		0
Barred Owl	42	32	10			6	6	39	16	11 (26)
Long-eared Owl	5	75					25			1 (20)
Short-eared Owl	1						100			0
N. Saw-whet Owl	3	100								1 (33)

^a Earthworms, crayfish, millipedes, centipedes, spiders, hair (only in Bald Eagle).

^b The number of empty stomachs were from birds examined at NWHRC.

by Fisher (1893) and May (1935) for larger geographic regions. In Virginia, Red-shouldered Hawks consumed more insects and fewer small mammals, amphibians, and reptiles than nationwide. American Kestrels took fewer small mammals but more small birds in Virginia. Although Cooper's Hawks have had a long-standing reputation for capturing poultry and game birds (Fisher 1893, McAtee 1935), none of these hawks examined from Virginia after 1924 had taken poultry or game birds. Similarly, no poultry or game birds were found in Red-tailed Hawks and Great Horned Owls from Virginia.

As might be expected from previous studies, in Virginia arthropods constituted the principal prey items of Broad-winged Hawks, American Kestrels, and Eastern Screech-Owls. Birds were the principal prey items of the Northern Harrier, Sharp-shinned and Cooper's hawks, Merlins, and Peregrine Falcons. The Meadow Vole accounted for 44% of all small mammals (shrews, mice, voles) taken.

Both the kestrel and screech-owl were adept at finding and catching arthropods in the winter months in addition to mice and a few birds. Specifically, kestrel winter foods included crickets, beetles, and grasshoppers, whereas the owl took caterpillars, spiders, and moths.

The large number and high percentage of empty stomachs in the two Accipiters (Table 2) are noteworthy. For both species, 70 % of the empty stomachs came from birds obtained during fall migration. At least two interpretations can be offered for the empty stomachs. Possibly, the species are inefficient in catching prey. The Sharp-shinned Hawk, for example, was deemed an unsuccessful hunter by Hill (1984) who found that only 10.9% of migrating birds had full crops even when their chief prey (Yellow-rumped Warbler) was abundant. But, in the present study it is also possible that the migrating hawks simply had not been hunting when they were killed.

The specific foods at specific sites and dates presented here will be useful to any programs dealing with the conservation and management of birds of prey in Virginia.

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APPENDIX A. Abbreviations for Counties and Cities in Virginia used in the text.

ACC	Accomack Co.	LUD	Loudoun Co.
ALB	Albemarle Co.	LUI	Louisa Co.
ALE	Alexandria City	LYC	Lynchburg City
ARL	Arlington Co.	MAT	Mathews Co.
AUG	Augusta Co.	MEC	Mecklenburg Co.
BOT	Botetourt Co.	MON	Montgomery Co.
BUK	Buckingham Co.	NFC	Norfolk City
CHA	Charles City Co.	NNC	Newport News City
CHS	Chesterfield Co.	NOA	Northampton Co.
CPC	Chesapeake City	ORA	Orange Co.
CUL	Culpeper Co.	PAG	Page Co.
DIC	Dickenson Co.	PRE	Prince Edward Co.
ESS	Essex Co.	PRG	Prince George Co.
FAC	Fairfax City	PRW	Prince William Co.
FAI	Fairfax Co.	RIC	Richmond City
FCC	Falls Church City	ROB	Rockbridge Co.
FAU	Fauquier Co.	ROI	Rockingham Co.
FRE	Frederick Co.	SHE	Shenandoah Co.
GIL	Giles Co.	SPO	Spotsylvania Co.
GLO	Gloucester Co.	STA	Stafford Co.
HAN	Hanover Co.	SUR	Surry Co.
HAR	Harrisonburg	VBC	Virginia Beach City
HEN	Henrico Co.	WAR	Warren Co.
HMC	Hampton City	WES	Westmoreland Co.
JCC	James City Co.	WIS	Wise Co.
KIG	King George Co.	WYT	Wythe Co.
KIW	King William Co.	YOR	York Co.
LXC	Lexington City		

APPENDIX B. Scientific names of vertebrate prey mentioned in the text.

Amphibians

Upland Chorus Frog (probably *Pseudacris feriarum*)
 Southern Leopard Frog (*Rana sphenocephala*)

Reptiles

Painted Turtle (*Chrysemys picta*)
 Eastern Fence Lizard (*Sceloporus undulatus*)
 Five-lined Skink (*Eumeces fasciatus*)
 Corn Snake (*Elaphe guttata*)
 Rough Green Snake (*Opheodrys aestivus*)

Birds

Northern Bobwhite (*Colinus virginianus*)
 Clapper Rail (*Rallus longirostris*)
 Sora (*Porzana carolina*)
 Spotted Sandpiper (*Actitis macularia*)
 Semipalmated Sandpiper (*Ereunetes pusillus*)
 Rock Dove (*Columba livia*)
 Mourning Dove (*Zenaida macroura*)
 Red-bellied Woodpecker (*Melanerpes carolinus*)
 Water Pipit (*Anthus spinoletta*)
 American Robin (*Turdus migratorius*)
 Hermit Thrush (*Catharus guttatus*)
 European Starling (*Sturnus vulgaris*)

Cedar Waxwing (*Bombycilla cedrorum*)
 White-eyed Vireo (*Vireo griseus*)
 Yellow-rumped Warbler (*Dendroica coronata*)
 Black-and-white Warbler (*Mniotilta varia*)
 Dark-eyed Junco (*Junco hyemalis*)
 Northern Cardinal (*Cardinalis cardinalis*)
 Swamp Sparrow (*Melospiza georgiana*)
 Indigo Bunting (*Passerina cyanea*)
 Field Sparrow (*Spizella pusilla*)
 Red-winged Blackbird (*Agelaius phoeniceus*)
 House Sparrow (*Passer domesticus*)

Mammals

Least Shrew (*Cryptotis parva*)
 N. Short-tailed Shrew (*Blarina brevicauda*)
 Silver-haired Bat (*Lasionycteris noctivagans*)
 Eastern Cottontail (*Sylvilagus floridanus*)
 Eastern Chipmunk (*Tamias striatus*)
 Eastern Gray Squirrel (*Sciurus carolinensis*)
 Harvest Mouse (*Reithrodontomys humulis*)
 White-footed Mouse (*Peromyscus leucopus*)
 Norway Rat (*Rattus norvegicus*)
 House Mouse (*Mus musculus*)
 Meadow Vole (*Microtus pennsylvanicus*)
 White-tailed Deer (*Odocoileus virginianus*)